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## ABSTRACT

A study examined the effects of within domain processing on the recall of idea units as well as the potential reversals in performance resulting from the passing of time. Subjects for the experiment were 89 undergraduate students randomly assigned to six conditions related to target words in a reading passage: counting e's, determining the preceding letter, creating a rhyme, creating a synonym, creating an antonym, and filling in a cloze blank that provided the initial letter of the word. The first three were physical domain processing conditions; the second three were semantic domain processing conditions. A seventh condition of normal reading was employed to give an indication of performance under noninterference conditions. The subjects read the directions for their condition, read a passage following condition directions, noted their reading time, and produced a written recall of as much of the passage as possible. A second recall test was given a week later. Analysis of the results indicated that the only marked differences were present in the normal reading condition, which produced the best performance, and the rhyming condition, which produced the worst performance. There were no significant differences on the delayed tests. When looking at main ideas recalled, it appeared that subjects benefited from the semantic processing conditions. (TJ)

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The Effect of Within Level Processing  
on Memory for Prose

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One of the characteristics that makes study of the reading process so interesting is the potential for encoding information represented in print at several different levels. Since the primary goal of reading is the reception of a meaningful message, the most productive level would be the semantic level. Craik and Lockhart (1972) have proposed a framework for considering various levels of encoded information and their effects on the durability of memory traces in long term memory. A modified statement of this original proposal (Lockhart, Craik, & Jacoby, 1975) described discrete domains or levels of processing which represent a shallow to deep progression in processing.

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That is, the encoding of surface or physical representations of print such as the orthography and its phonemic counterpart, produces less durable memory traces than would encoding at a deeper semantic level. While outlining the depth of processing notion, Lockhart et al. (1975) also proposed that within each domain there are differences in stimulus elaboration which may also affect memory and produce an additional depth effect.

Specific to reading, a number of studies have demonstrated the positive effects of encouraging a reader to process more deeply. Andre and Sola (1976) found that subjects primed with paraphrased questions remembered more of what they read than subjects who were primed with verbatim questions. Kane and Anderson's investigation (1977) revealed that subjects who were forced to process more deeply by completing the last word of a sentence learned more than subjects who read the complete sentence. Similarly they demonstrated that subjects who were led to deeper processing within sentence completion task recalled more on a delayed recall measures. In each study, subjects were prompted to process more deeply within the semantic domain.

Of relevance to such effects of depth of processing are the findings of reversals in performance from short term to long term recall following interference. Gotz and Jacoby (1974) and Pellegrino, Siegel, and Dhawan (1976) have demonstrated that minimal interference allows for higher recall in short term memory when compared to high interference but results in lower recall in long term memory. These findings have been interpreted as the result of deeper processing to meet the challenges of the higher interference condition.

The present study attempted an examination of the effects of within domain processing on the recall of idea units as well as the

potential reversals in performance, resulting from the passing of time. The prediction was made that the within levels processing effect would be reflected in an interaction between processing condition and time.

### Method

#### Sample

One hundred and five undergraduate students enrolled in psychological foundations and reading courses participated in the experiment as part of their course requirements. The students were randomly assigned in equal numbers to each condition. Sixteen students were eliminated from the sample as they failed to return for the delayed recall measure.

#### Task

The participants were given a booklet which contained a blank coversheet, directions for the specific condition, the passage, and a recall sheet. They were tested in groups of approximately 30. Participants were asked to read the directions and begin reading the passage on a signal. Upon finishing the passage they were instructed to note their reading time and to produce a written recall of as much of the passage as possible. Although students were not informed, one week later they were asked to produce a second recall of the passage. A sheet listing examples of the seven conditions was given to the participants and they were asked to circle the one in which they participated. They were then asked to recall as much of the passage as possible.

#### Materials

The passage was selected from high school level material, Fry readability of 10th grade. The target words were selected by using a

pattern of approximately every fifth word. However, only those words functioning as nouns, verbs, adjectives, and adverbs were selected. Following this constraint, some modifications were made in the selection criteria when the fifth word was inappropriate: 1) the sixth word was selected first, 2) the fourth was the next choice, and 3) the seventh word was the last choice. This modification accounted for all target word selections. To avoid making the task overly difficult, a final constraint was applied which disallowed the selection of two consecutive four word patterns. The selection process yielded 59 target words for the 302 word passage, an average deletion pattern of 5.19 words. In all conditions but the cloze condition, each target word was underlined.

#### Conditions

Physical Domain processing conditions in predicted order of difficulty, easiest first, were:

1. Count the number of e's in the target word and write the number over the word.
2. Determine the preceding letter of the alphabet for the beginning letter of the target word and write it over the word.
3. Produce a word or non-word which rhymes with the target word and write it over the word.

The semantic domain processing conditions in predicted order of difficulty were:

1. Produce a synonym for the target word and write it over the word.
2. Produce an antonym for the target word and write it over the word.

3. Fill in cloze blank which provided the initial letter of the word.

A seventh condition of normal reading was employed to give an indication of performance under non-interference conditions.

#### Scoring

The passage and recalls were analyzed using a discourse analysis technique adopted from Grimes (1975) and Meyer (1975) and used by Taylor (1978). The passage contained 103 total idea units, 23 of which were main ideas. There was high agreement on the total idea units (93%) in the original analyses of the passage between two persons trained in this procedure and complete agreement on the main idea and detail units.

#### Design and Analysis

A 2 X 6 factorial design was used, time by processing condition. Total recall, main idea and detail scores were analyzed using analysis of variance procedures. Post hoc analyses were conducted with the Newman Keuls procedures for testing of significant mean difference.

#### Results

Table 1 displays the means and standard deviations for immediate and delayed, total recall for each condition. The order of best to worst performance is normal reading, synonym, antonym, e's, cloze,

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Table 1  
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alphabet and rhyme. However, the marked differences appear only to be present in the normal reading and the rhyming condition. In the delayed condition, the differences seem to decrease proportionately except for

rhyme, which does not appear to suffer the decrement in performance demonstrated by the other conditions.

The analysis of variance, for total recall did not indicate the existence of a main effect for condition [ $F(5,69) p > .07$ ]. For main idea units, the analysis of variance did reveal a main effect for condition of processing [ $F(5,69) = 3.9, p < .01$ ] but no significant interaction was found. A post hoc analysis of the means using the Newman Keuls procedure confirmed that the effect was primarily caused by the superiority of the semantic processing conditions over the physical processing conditions. There were no semantic conditions significantly lower than physical conditions. Conversely, there were a number of semantic conditions, except for the delayed cloze, which were significantly greater ( $p < .05$ ) than the physical. The immediate synonym condition was greater than all physical conditions as was the delayed condition, except for the immediate "e" counting task and the preceding letter task. The immediate antonym reflected the same differences as the delayed synonym. The delayed antonym was greater than the immediate rhyme. The immediate cloze also differed from the immediate rhyme as well as the delayed rhyming condition.

In the analysis of variance for details, a different picture emerged. No significant main effect for condition was present [ $F(5,69) p > .38$ ] but a time by condition interaction was [ $F(1,51) = 2.35, p < .05$ ]. For detail units, the semantic conditions apparently remained stable in their relationship to each other and did not interact. However, the semantic conditions and two of the physical conditions, preceding letter and e's, all experienced some expected decrement, but the rhyme condition maintained its performance.

The Newman Keuls procedures verified that all of the immediate recall conditions except the rhyme condition did not differ significantly from each other ( $p > .05$ ). All of these conditions, with the exception of the preceding letter condition, differed significantly from the rhyme condition. There were no significant differences among any of the delayed means.

#### Discussion

When considering the total number of idea units recalled, the main effect for processing condition only approached significance and pointed toward a trend in the expected direction. Similarly, the predicted interaction was not present. However, when looking at only the main ideas recalled, a significant main effect was found for processing condition. For main ideas, the subjects benefited from the semantic processing conditions. Possibly, the deeper processing required by the semantic condition allowed the readers to extract the hierarchical structure of the text more readily than the readers in the physical condition who were being encouraged to focus their attention on the surface structures of the text. There was no evidence of intra-domain processing effect on main ideas. Perhaps the stability of the main ideas within the domain suggests that the saliency they gain from their position in the text base may insulate them from the processing manipulations used in the investigation.

The predicted interaction was revealed when recall for details was considered. However, the interpretation for this interaction must be guarded because of its dependency on the stability of only one condition. According to our reasoning, we expected the rhyming condition to remain relatively stable when compared with the easier physical conditions. That is the more difficult task would not

experience as much loss as the easier condition over time because of the deeper processing within the domain. Unexpectedly, the semantic conditions did not manifest the same pattern. The semantic conditions did interact with the rhyme conditions. A possible alternative explanation of this interpretation rests in the obvious difficulty of the rhyming task with respect to recall. That is, the amount of detail recall was so small that the stability of the recall was due to a baseline effect rather than a processing effect.

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Table 1  
Means and Standard Deviations for  
Total Idea Units for Immediate  
and Delayed Recalls

|      |      | Nr    | E's   | PL    | Rhy  | Syn   | Ant   | Cl    |
|------|------|-------|-------|-------|------|-------|-------|-------|
| Imm. | Mean | 27.0  | 15.07 | 12.67 | 7.4  | 17.75 | 16.38 | 13.64 |
|      | SD   | 8.48  | 11.76 | 8.17  | 5.39 | 9.40  | 6.87  | 7.45  |
| Del. | Mean | 17.64 | 8.93  | 8.67  | 6.73 | 12.08 | 9.62  | 8.91  |
|      | SD   | 8.95  | 6.76  | 6.16  | 6.17 | 5.88  | 6.18  | 4.37  |

Nr = Normal Reading  
E's = Counting e's  
Pl = Preceding Letter

Rhy = Rhyme  
Syn = Synonym  
Ant = Antonym  
Cl = Cloze